TUMANOV, S.G.

USSR/Chemical Technology. Chemical Products and Their Application -- Silicates. Glass. Ceramics. Binders, I-9

Abst Journal: Referat Zhur - Khimiya, No 2, 1957, 5151

Author: Tumanov, S. G., Maslennikova, G. N.

Institution: Academy of Sciences USSR

Title: Thermal Analysis as a Method for the Determination of the Degree of Kaolinization of Spodumene

Original Publication: Dokl. AN SSSR, 1956, 107, No 1, 119-121

Abstract: Thermal analysis of 3 specimens of spodumene (S) of different degree of disintegration, has revealed that on alteration of S the degree of its kaolinization increases. Chemical analyses and determinations of the specific gravity, have shown that with increasing extent of S changes the content of Na_2O increases and that of Li_2O decreases; losses on calcining become greater; specific gravity decreases.

Card 1/1

1. TUMAYCV, S. IA.

2. USSR (600)

4. Ceramic Industries

7. Quality of ceramic tiles for lining digesters, Bum. prom. 28, no. 3, 1953.

9. Monthly List of Russian Accessions, Library of Congress, May 1953. Unclassified.

TUMANOV, Saveliy Ivanovich; ALEKSEYEV, V.A., red.; ZYKINA, T.N., tekhn. red.

[Elementary algebra]Elementarnaia algebra; posobie dlia samoobrazovaniia. Izd.2., dop. i ispr. Moskva, Uchpedgiz, 1962. 855 p. (MIRA 16:3)
(Algebra)

TUMANOV, Saveliy Ivanovich; MOLCHANOV, M.P., red.; KORNEYEVA, V.I., tekhn.red.

[Elementary algebra; textbook for self study] Elementarnaia algebra; posobie dlia samoobrazovaniia. Moskva, Gos.uchebno-pedagog.izd-vo M-va prosv.RSFSR, 1960. 685 p. (MIRA 13:7)

(Algebra)

TUMANOV, S.Ya., master-obmurovshchik

Some proposals on the maintenance and repair of digesters.
Bum.prom. 37 no.6:21-22 Je '62. (MIRA 15:6)
(Autoclaves—Maintenance and repair)

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S/137/61/000/011/118/123
A060/A101

AUTHORS: Tumanov, V.I., Anikeyeva, N.P.

TITLE: Spectral method of analyzing ammonium molybdate for admixtures

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 11, 1961, 10, abstract 11K59. ("Sb. tr. Vses. n.-i. in-t tverdykh splavov", 1960, no. 3, 64 - 71)

TEXT: A method has been worked out for the spectral analysis of $(NH_4)_2MoO_3$ for admixtures of Ca, Mg, Al, Fe, Si, Mn, Ni, Na in the concentration range (in %): CaO 0 001 - 0.02, MgO 0.0008 - 0.014, Al_2O_3 0.004 - 0.07, Fe_2O_3 0.008 - 0.05, Ni 0.001 - 0.02, Mn 0.002 - 0.04, SiO_2 0.01 - 0.2, NaCl 0.02 - 0.4. The ammonium molybdate is converted into a carbide having very low volatility. The most convenient form of a compound for the formation of carbides is Mo anhydride which is obtained by calcining $(NH_4)_2MoO_3$ at a temperature of 450°C. The analysis is carried out on the ИСП-22 (ISP-22) spectrograph. The exciter source for the spectrum is a dc arc obtained from a ВАР-33 (VAR-33) mercury rectifier. The current is 5 amps, one uses carbon electrodes with 6 mm diameter where the upper is turned to a cone with truncated surface

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S/137/61/000/011/118/123
A060/A101

Spectral method of .... .

2 mm diameter, the lower has a cup 3 mm diameter and 3 mm depth. The Mo anhydride is mixed with the carbon mixture in the ratio 1:1. This ratio makes it possible simultaneously to obtain carbides, carry out the exposure without roasting, and lower the current intensity. The relative error of the method constitutes 4 to 17%. It takes about 2.5 h to determine 8 elements in one assay.

L. Vorob'yeva

[Abstracter's note: Complete translation]

Card 2/2

TUMANOV, V.I., inzh.

Inductive impedances of a synchronous machine with an extraneously short-circuited magnetic circuit under steady-stage symmetrical operating conditions. Vest. elektroprom. 31 no.10:7-10 O '60.
(MIRA 15:1)
(Electric motors, Synchronous) (Magnetic circuits)

18.1247 1454

28879
S/180/61/000/004/017/020
E073/E535

AUTHORS: Baskin, M.L., Savin, A.V., Tumanov, V.I. and Eyduk, Yu.A. (Moscow)

TITLE: Mutual solubility of copper and molybdenum and certain properties of molybdenum-copper alloys

PERIODICAL: Izvestiya Akademii nauk SSSR. Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1961, No.4, pp.111-114

TEXT: Mo-Cu alloys are extensively used for electric contacts. The authors prepared alloys containing 1.5 to 14% Cu by means of current powder metallurgy methods. Sintering of molybdenum was carried out at 1700°C and the alloys of molybdenum with low contents of copper (1.5 to 10% by weight) were sintered at the same temperature. At lower temperatures, either no sintering took place at all or the material was very porous. The alloy with 14% Cu sintered at 1600°C. The porosity of the produced alloys (determined metallographically) was about 0.6 volume % and that of pure Mo was about 1 volume %. The grain size of the molybdenum phase was approximately the same for all the alloys and also for pure molybdenum, i.e. mainly 25-30 μ. To obtain grains

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of this size molybdenum had to be sintered for a duration almost twice as long as that of the alloys. The properties of the starting materials, Mo and Cu, were as follows: bulk density 1.60 and 1.49 g/cm^3, respectively; adsorption of methanol vapours 0.200 and 0.026 mg/g, respectively. The average grain size of the starting powders, Mo and Cu, was 1 to 2 μ. To prevent contamination with iron, the powders were mixed in molybdenum lined mills. The specimens were sintered in molybdenum boats in resistance furnaces with an open molybdenum heater in a hydrogen atmosphere for a duration of one hour and the specimens of pure molybdenum for a duration of two hours. Heat treatment was as follows: heating in a hydrogen atmosphere to 950°C, holding at that temperature for 5 hours and quenching in oil at room temperature. Data on the Mo-Cu alloys are given in Table 2, the column headings from left to right being as follows: Cu, wt.%; specific weight, d, g/cm^3; electric resistance ρ x 10^2 Ohm mm^2/m; λ x 10^6 1/deg; phase composition, Mo - denoting Mo-base phase, Cu - denoting copper-base phase (To же - ditto); lattice parameter kX; Mo-base phase, Cu-base phase. The tabulated electric

resistance values are averages from 36 measurements, whereby the maximum error was +2% and the deviations from the average value did not exceed 0.3%. The coefficient of linear expansion was determined by means of a dilatometer with quartz rods and indicator head in the temperature range 18 to 400°C, the error being within the limits of ±2.5%. To determine the influence of admixtures which are important in the industrial manufacture of Mo-Cu alloys, a series of melts were produced containing admixtures of C, Si and SiO_2. Table 3 gives the obtained results for Mo-Cu alloys with 3, 5 and 8% Cu, respectively and the following admixtures in wt.%: 0.05% C, 0.05% Si, 0.10% Si, and 0.50% SiO_2 ($\rho \cdot 10^2$ Ohm mm^2/m; a,kX). The influence of nickel (wt.%) on the electric resistance ($\rho \times 10^2$ Ohm mm^2/m) of Mo-Cu alloys with 5% Cu was as follows: 0 - 7.10; 0.5 - 10.31; 1.0 - 12.94; 3.0 - 14.92; 5.0 - 15.29. L. G. Grigorenko, A. A. Maksimov and A. A. Cheredinov participated in the experimental work, L. Kh. Pivovarov carried out the X-ray structural analysis and M. N. Nalimova carried out the metallographic investigations. There are 3 figures, 4 tables and

28879

Mutual solubility of copper ... S/180/61/000/004/017/020
E073/E535

12 references: 4 Soviet and 8 non-Soviet. The English-language references read as follows: Ref.3, C. L. Sargent, J.Amer.Chem. Soc., 1900, v.22, p.783; Ref.7, M. Hansen, Constitution of binary alloys, second edition, New York - Toronto - London, 1958; Ref.12, W. P. Syks, R. Kent, van Horn and C. M. Tucker, Trans. AIME, 1935, v.117, p.173.

SUBMITTED: July 15, 1960

Table 3

Admixture, wt% Примесь, вес. %	3% Cu		5% Cu		8% Cu	
	$\rho \cdot 10^3$, ом·мм²/м	a, kX	$\rho \times 10^3$, ом·мм²/м	a, kX	$\rho \times 10^3$, ом·мм²/м	a, kX
—	7.74	3.1397	7.10	3.1397	7.25	3.1397
0.05% C	8.55	3.1393	7.75	—	7.65	3.1395
0.05% Si	—	—	—	—	8.58	—
0.10% Si	—	—	—	—	9.61	—
0.50% SiO_2	—	—	17.90	3.1375	17.40	—

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30904
S/180/61/000/005/016/018
E202/E335

15.2400

AUTHORS: Funke, V.F., Tumanov, V.I. and Trukhanova, Z.S.

TITLE: The effect of alloying on the structure and properties of tungsten carbide-cobalt alloys

PERIODICAL: Akadeniya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, no. 5, 1961, 101 - 108

TEXT: The authors briefly describe the properties of the cermets WC-Co, TiC-WC-Co, WC-Ni and TiC-Ni in the first part of the paper and, in particular, the relations between the composition of the carbide phase and structure and properties of the above systems. The effect of the binding phase, i.e. Ni or Co, on the overall hardness and bending strength is also described [Abstracter's note: this part is largely a recapitulation of the data known in the West from such sources as Dawihl, Norton, Skaupy, Schwarzkopf, Kieffer et al]. The original contribution of the authors comprises studies on the effect of small additions of Cr, Al, Mo, Cu and CrB on the structure and properties of the WC-Co alloys. The alloying

Card 1/4

The effect of alloying ....

components were introduced to the mixture during grinding. The final analysis was carried out with the help of X-ray diffractometry of the sintered alloy and separate analysis of the binding and carbide phases. Separation of the phases was carried out electrochemically. The samples underwent bending tests and their hardness was measured (VPN) at 20, 600 and 800 °C. The chemical composition and lattice parameters of the binding and carbide phases are entered in Table 2. Whereas Cu and Al are both readily soluble in the binding phase in any quantity, their interaction with the carbide phase varies. Whilst 57% of the Al passes into the carbide phase, none of the Cu reacts with it. Mo and Cr distribute themselves between the carbide and binding phases which will contain some of the dissolved WC. It was also observed that, at room temperature, all the alloying elements with the exception of Cu, lower the bending strength of the WC-Co. This lowering is greatest with CrB, followed by Al, Cr and Mo. Cu additions up to 1% improve the bending strength. However, additions in excess of this figure lower both the strength and hardness of the WC-Co alloys.

Card 2/[illegible]4

The effect of alloying ....

The authors stress the fact that the alloying of the carbide phase should be effected with additives which, in addition to increasing the hardness and refractory properties of the carbide skeleton, will also improve its wettability with respect to the binding phase. The optimal conditions are reached when each grain of the carbide phase is fully wetted, i.e. when the carbide phase is discontinuous. On the other hand, the composition of the binding phase should cause a minimum lowering of the strength and plasticity of the alloy at the ambient temperature, while securing maximum possible strength at the working (i.e. high) temperature. The X-ray-diffraction studies were carried out by A.Ye. Koval'skiy and L.Kh. Pivovarov. There are 4 figures, 3 tables and 16 references: 11 Soviet-bloc and 5 non-Soviet-bloc. The four latest English-language references mentioned are: Ref. 3 - R.P. Felgar, I.D. Lubanh - Proc. Amer.Soc.Test Mater., 1957, 58, 770-788; Ref. 9 - N.M. Parikh, J. Amer.Ceram.Soc., 1957, 40, 10, 335-339; Ref. 10; M. Himenik, N.M. Parikh, J. Amer.Soc., 1956, 39, 2, 60. Cermets 1; Ref. 14 - J. Phillips, L. Welfred, J. Inst. Metals, 1956, 984, v. 23, London. The Institute of Metals.

Card 3/3 4

The effect of alloying ....

SUBMITTED: January 28, 1961

Table 2: Chemical composition and results of the X-ray diffraction study of the binding and carbide phases of WC-Co alloys.

Key:- 1 - Alloying component; 2 - Co, wt.%;
3 - Alloying component, wt.%;
4 - Content of binding phase; 5 - Alloying component; 6 - wt.%; 7 - at.%;
8 - Alloying component in carbide phase;
9 - Lattice parameters in kX; 10 - WC-phase;
11 - Solid solution based on cobalt (a);
12 - % on the basis of total content in the alloy.

Card 4/[illegible] 11

S/180/61/000/006/017/020
E073/E535

AUTHORS: Tumanov, V.I., Funke, V.F., Baskin, M.L. and Novikova, T.A. (Moscow)

TITLE: Physical properties of the alloys tungsten carbide-cobalt

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo. No.6, 1961, 144-148

TEXT: Systematic data on the physical properties of W-Co alloys have not been published and, therefore, the authors have investigated the specific resistance, the Young modulus, the coefficient of linear expansion and the hardness of WC-Co alloys containing various quantities of the binder phase with various sizes of the tungsten carbide grains. For the tests, specimens containing 0 to 100% Co and specimens containing 6 wt % Co were investigated, differing as regards the size of the tungsten carbide grain. The alloys were produced according to standard technology. The main series of alloys with various contents of binder had a practically equal average diameter of the tungsten

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carbide grain of 2.5 μ. The phase composition of the alloys throughout the entire range of changes of the Co content remained constant: phase WC plus solid solution of tungsten and carbon in cobalt. The porosity of the alloys did not exceed 0.2 vol %, the tungsten carbide had a porosity of 3.5%. The sintered specimens were quenched and annealed; the quenching consisted of heating in a hydrogen atmosphere at 1000°C for 12 hours and cooling in the water-cooled cooler of the furnace. The annealing was at 1000°C for 12 hours in a hydrogen atmosphere followed by cooling to 800°C and holding at that temperature for 2½ hours and then cooling to room temperature at an average rate of 1.5 °C/min. The specific resistance ρ, the modulus of elasticity E, the coefficient of linear expansion α and the hardness H_V were determined on quenched and annealed specimens. The specific electric resistance was determined by the compensation method using a potentiometer, the maximum error being 2.0%; the coefficient of linear expansion was determined with a quartz rod dilatometer in the range 18 to 420°C with an error of 2.5%; the Young modulus was determined by a dynamic method with

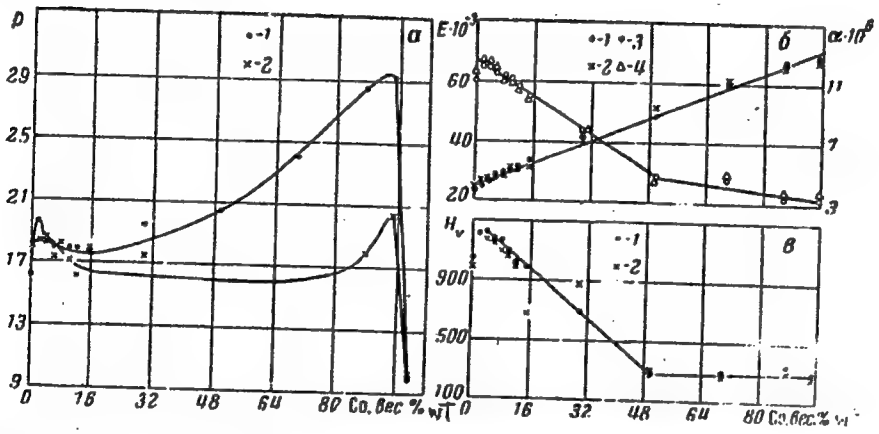
an error of 1%. Fig.1 shows the dependence on the cobalt content, wt.% of the following: specific resistance ρ, μohm·cm (a); modulus of elasticity E, kg/mm^2 and the coefficient of linear expansion α, 1/deg (б); hardness H_v, kg/mm^2 (в). Curves 1 and 3 - after quenching, curves 2 and 4 - after annealing. The obtained experimental results show that the specific electric resistance is the most sensitive physical characteristic of WC-Co alloys which provides an indication of the state and the composition of the binding and the carbide phases and of the structure. The modulus of elasticity and the coefficient of linear expansion indicate predominantly the quantitative relations between the tungsten carbide and the cobalt in the alloy and depend little on heat treatment and composition of the binding phase. The modulus of elasticity changes considerably with the grain size of the tungsten carbide. The results confirm the view of the existence of a continuous cobalt phase in alloys of this type. L. G. Grigorenko and A. A. Cheredinov participated in the experiments. There are 2 figures and 4 references: 2 Soviet-bloc and 2 non-Soviet-bloc. The English-language references read as follows: Ref.1: Dawihl W. and Hinnuber J. The structure of hard metal alloys. Kolloid-Z.,

Physical properties of ...

S/180/61/000/006/017/020
E073/E535

1943, 104, No.2/3, 233; Ref.2: Gurland J. and Norton J. Role of the binder phase in cemented tungsten carbide-cobalt alloys. Metals, 1952, 4, No.10, 1051.

SUBMITTED: June 18, 1961



Card 4/4

Fig.1

ACCESSION NR: AP4034055 S/0126/64/017/004/0572/0577

AUTHORS: Kreymer, G. S.; Tumanov, V. I.; Kamenskaya, D. S.; Pavlova, Z. I.

TITLE: On the resistance limit and the mechanism of failure of the metal ceramic solid alloy of WC and Co at compression

SOURCE: Fizika metallov i metallovedeniye, v. 17, no. 4, 1964, 572-577

TOPIC TAGS: resistance limit, yield stress, stress analysis, cobalt, carbide phase, dislocation effect, tungsten carbide

ABSTRACT: The purpose of this work was to obtain systematic experimental data on the effects of composition and carbide grain size on the resistance limit of the alloy WC-Co during compression. Five sets of alloys were prepared with varying sizes of carbide grains (1.4, 1.7, 1.9, 3.3, and 5.3 μ). In each set specimens were prepared containing varying percentages of cobalt. The different grain sizes were obtained by changing the initial temperature at which the powder was formed. The results showed that (with increasing cobalt content) the resistance limit increased initially and then decreased monotonically; all the curves reached a maximum. The highest value of the resistance limit (500 kg/mm^2) for a grain size of 1.4-1.7 μ was attained for 5% by wt (8.6% by vol) of cobalt in the alloy.

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ACCESSION NR: AP4034055

The resistance limit is given by the theoretical expression

$$\sigma(S_T) = \frac{A}{v^{1/3}} + B;$$

$$\sigma(S_T) = \frac{C}{v^{1/3}} + D,$$

where σ is the resistance limit, S_T the yield limit, v the volumetric content of Co, and A,B,C,D are constants. The theoretical dependence of the resistance limit on the grain size is given by

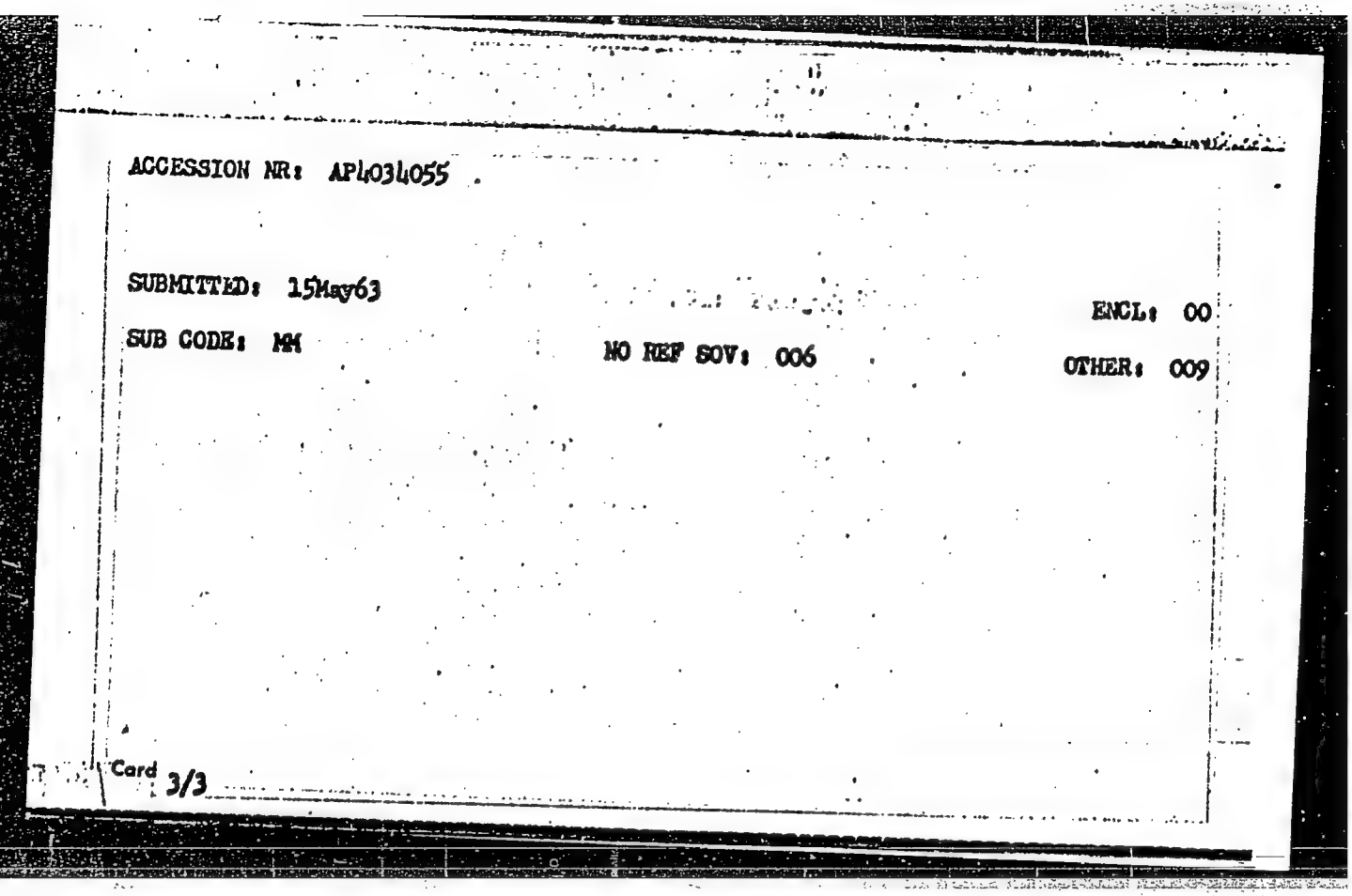
$$\sigma_c \cong \frac{a}{d} + B';$$

$$\sigma_c \cong \frac{b}{d^{1/3}} + D',$$

where d is the grain size and a,b,B'D' are constants. The form of the experimental curves agrees with these expressions. Finally, it was shown that these dependences were adequately described by the dislocation theory of E. Orowan (Symposium on Internal Stresses in Metals and Alloys, Inst. Metals, London, 1948) and of F. V. Lenel and G. S. Ansell (Powder Metallurgy. Proc. intern. Conference held in N.J., June 13-17, 1960, p.267). Orig. art. has: 7 formulas, 3 figures, and 1 table.

ASSOCIATION: Vsesoyuznyy institut tverdykh splavov (All Union Institute for Solid Alloys)

Card 2/3



ACCESSION NR: AP4034055

SUBMITTED: 15May63

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SUB CODE: MM

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OTHER: 009

Card 3/3

best wettability of the carbide systems tested was observed at a ratio of carbon-

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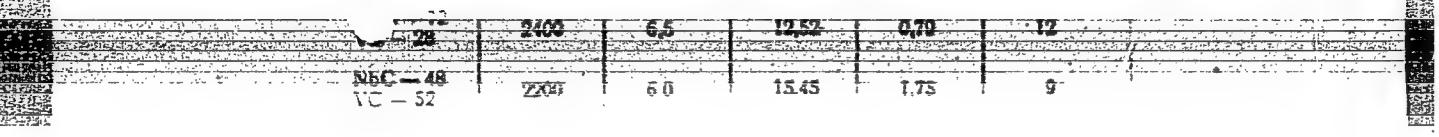

28	2400	6,5	12,52	0,79	12
NBC — 48 VC — 52	2249	6 0	15.45	1,75	9

NbC—65	2500	5,61	11,3	0,42	6
NbC—45	2250	5,4	12,17	0,69	13
TiC—74 NbC—26	2250	5,7	12,24	0,69	16
TiC—87 NbC—13	2200	5,26	11,93	0,79	12

SOURCE: AN SSSR. Izvestiya. Metallurgiya i gornoye delo, No. 5, 1964, 111-114

greater when melting was in a helium atmosphere than in a hydrogen atmosphere.

APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001757420012-2"

ACCESSION NR: AT4030800 S/0000/63/000/000/0141/0151

AUTHOR: Tumanov, V. I., Funke, V. F., Belen'kaya, L. I. Usol'tseva, L. P.

TITLE: Effect of alloying on surface tension of the iron group metals and the wettability of aluminum oxide

SOURCE: AN UkrSSR. Institut metallokeramiki i spetsial'ny*kh splavov. Poverkhnostny* ye yavleniya v rasplavakh i protsessakh poroshkovoy metallurgii (Surface phenomena in liquid metals and processes in powder metallurgy). Kiev, Izd-vo AN UkrSSR, 1963, 141-151

TOPIC TAGS: cobalt alloy, nickel alloy, liquid phase surface tension, alloy surface tension, aluminum oxide, aluminum oxide wettability, cobalt copper alloy, nickel copper alloy

ABSTRACT: The effects of alloying Co and Ni with Cu, Mo, W or Ti (0.5, 1.5 and 20 at. %), as well as carbides of the latter three (5 at.%), on the surface tension of the liquid phases and the wetting of Al_2O_3 were studied on alloy samples (h = 5-6 mm, ϕ = 12 mm)

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ACCESSION NR: AT4030800

and Al_2O_3 substrates (h = 4 mm, ϕ = 20 mm, porosity up to 0.2%). Tests were carried out in a vacuum (5 x 10^{-5} mm Hg) at about 1500C (1400C for Cu-containing alloys). The contact angle θ was determined experimentally, using the droplet-at-rest method (accuracy 1-2%). Surface tension σ_j, interphase tension σ_{si} and work of adhesion W_A were calculated. As shown in Fig. 1. of the Enclosure, addition of up to 1.0 at.% alloying elements, especially Cu, lowered 0, but further additions had little effect. Small amounts of alloying elements (0.5-1 at.%), except for Ti, also lowered σ_j (see Figs. 2 and 3 in the Enclosure). Alloying with 5 at.% tungsten carbide lowered θ and σ_j slightly in both Ni and Co; molybdenum carbide had no effect on these parameters in Ni and little effect in Co. Only titanium carbide lowered θ significantly in Ni (from 120 to 62°) and Co (from 120 to 90°), while simultaneously increasing the surface tension. X-ray diffraction patterns of the contact areas between the drop and the substrate show that reactions take place between the liquid metal and the substrate, resulting in formation of a transition layer containing $CoAl_2O_4$ and $NiAl_2O_4$ with a spinel structure. In the case of Ni alloyed with titanium carbide, the transition zone also contained TiC, TiO_2 and NiAl. The authors demonstrate relationships between Θ, σ_j, σ_{si} and W_A, on

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ACCESSION NR: AT4030800

the one hand, and the atomic diameter and thermal stability of the alloying component oxides, on the other. The lowest Θ (62°) and maximal W_A (3600 ergs/cm^2) were found in Co + 5 at.% TiC. "The X-ray structural analysis was carried out by Eng. N. S. Urazaliyev." Orig. art. has: 5 tables and 6 graphs.

ASSOCIATION: Vsesoyuzn*y nauchno-issledovatel'skiy institut tverdy*kh splavov, Moscow (All-Union Scientific Research Institute for Solid Alloys)

SUBMITTED: 23Nov63 ENCL: 03

SUB CODE: MM NO REF SOV: 005 OTHER: 006

Card 3/6

ACCESSION NR: AT4030800

ENCLOSURE: 01

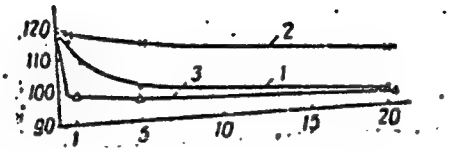

Fig. 1. Contact wetting angle (0) for Ni, Co and their alloys on an Al_2O_3 substrate, alloyed with W (1), Mo (2) and Cu (3). Ordinate = 0 in degrees; abscissa = at. % alloying element.

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ACCESSION NR: AT4030800

ENCLOSURE: 02

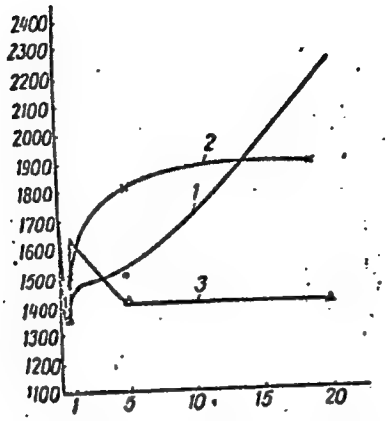

Fig. 2. Surface tension of Ni and its alloys (Al_2O_3 substrate), alloyed with W (1), Mo (2) and Cu (3). Ordinate = σ_j in ergs/cm^2; abscissa = at. % alloying element.

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ENCLOSURE: 03

ACCESSION NR: AT4030800

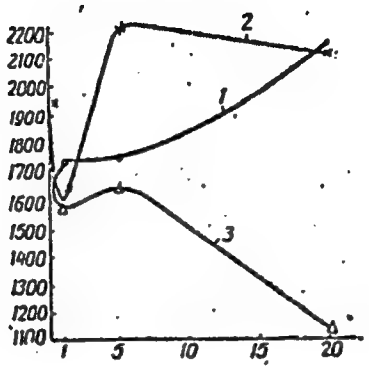

Fig. 3. Surface tension of Co and its alloys (Al_2O_3 substrate), alloyed with W (1), Mo (2), Cu (3), 0.5 at.% Ti (x). Ordinate and abscissa as in Fig. 2.

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31740
S/136/61/000/012/004/006
E193/E383

152600 3209 3309

AUTHORS: Tumanov, V.I., Baskin, M.L. and Anders, N.R.

TITLE: Some properties of cobalt-bonded tungsten carbides

PERIODICAL: Tsvetnyye metally, no. 12, 1961, 68 - 73

TEXT: Cemented carbides are used in increasing quantities as materials of construction and this prompted the authors to undertake the present investigation, whose object was to determine the Young modulus, E, electrical resistivity, ρ, and linear coefficient of thermal expansion, α, of WC-Co alloys in relation to their composition and structure. The composition of experimental alloys is included in Table 1. The results of measurements are reproduced graphically in Figs. 1-3, where the curves marked M, C and B relate to specimens with the average grain size 1.2 - 1.5 μ, 1.5 - 2.5 μ and 3.4 - 5.0 μ, respectively. In Fig. 1, E (kg/mm^2) is plotted against the Co content (wt.%) in the alloy. The concentration dependence of $\alpha(10^{-6}/^{o}C)$ and

Card 1/6

Some properties of ....

ρ (Ω mm^2/m is similarly represented in Figs. 2 and 3. The general conclusion reached was that E, α and ρ depend not only on the composition (Co content) but also on the grain size of cemented carbides, the maximum value of each of these properties being attained in finely-crystalline materials. There are 3 figures, 5 tables and 17 references: 7 Soviet-bloc and 10 non-Soviet-bloc. The four latest English-language references mentioned are: Ref. 6 - A.G. Johnson - Technical Note 3309. Nst. Advisory Committee on Aeronautics, Washington, D.C.D, CC 1954; Ref. 7 - E. Lardner, Mc.J. Gregor. Inst. of Metals, 1952, no. 80, 369; Ref. 8 - Felgar. Lubahn, American Society for Testing Materials, 1957, v.57; Ref. 9 - W.W.Wellborn, Mater. Design Engns., 1959, v.49, no. 2, 79.

L.G. Grigorenko and A.A. Cheredinov participated in the work.

31740

Some properties of ... S/136/61/000/012/004/006
E193/E383

Table 1:

Марка сплава Alloy type	Химический состав в % (1) (5) $C_{общ}$	(6) $C_{св}$	S	O_2	Fe	Свойства (2) (7) уд. вес, г/см³	(8) прочность, кг/мм²	(9) твердость H_{RA}	коэрцитивная сила, эрст (3)
Группа									
ВК3М	5,77	0,05	3,16	0,37	0,11	15,03	116	—	264
ВК6М	5,96	0,10	5,95	0,39	0,10	14,86	132	90,5	248
ВК10М	—	—	9,93	0,44	0,10	14,53	200	90,5	194
ВК15М	5,11	0,06	15,15	0,42	—	13,91	192	88,2	129
ВК20М	—	—	19,81	0,37	0,04	13,60	204	86,5	99
ВК6А	5,60	0,03	5,80	0,37	—	14,92	122	90,7	172
Группа									
ВК4	5,79	0,05	4,01	0,35	0,12	15,07	153	90,2	146
ВК6	5,78	0,06	6,04	0,38	—	14,85	152	90,9	168
ВК8	5,65	0,05	7,86	0,38	—	14,65	198	89,9	140
ВК15	5,22	0,04	14,73	0,41	—	14,02	212	87,0	103
ВК20	4,92	0,05	19,81	0,42	0,11	13,54	218	87,0	87
ВК30	4,30	0,05	30,20	0,37	0,14	12,67	226	85,0	63
Группа к									
ВК4В	5,86	0,07	4,20	—	0,15	14,99	155	89,7	88
ВК6В	5,78	0,12	6,00	—	0,20	14,81	158	88,5	80
ВК8В	5,70	0,08	8,26	0,36	0,09	14,52	162	86,7	66
ВК11В	5,44	0,11	11,06	0,39	0,30	14,39	175	86,7	55

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Some properties of ..

Table 1 (cont.):

Микроструктура (3) 31740

(11) пористость, %	(12) наибольший размер отдельных пор, μ	(13) графит. включения, %	(14) величина зерен фазы WC в μ и объемное содержание, %								
			1	2	3	4—5	6—7	8—10	11—15	16—20	21—25
мелкозернистых сплавов (14)											
До 0,2	—	Нет	62	30	8	0	0	0	0	0	0
До 0,2	—	0,5	69	22	9	0	0	0	0	0	0
До 0,2	—	Нет	84	16	0	0	0	0	0	0	0
До 0,2	—	Нет	56	31	11	1	1	0	0	0	0
До 0,2	—	Нет	65	30	3	2	0	0	0	0	0
0,2	5—10	0,5	46	40	11	1	1	1	0	0	0
среднезернистых сплавов (15)											
До 0,2	—	До 1,0	43	36	21	0	0	0	0	0	0
До 0,2	10	Нет	53	40	6	0	1	0	0	0	0
До 0,2	5—10	Нет	45	43	9	2	1	0	0	0	0
До 0,2	—	0,5	57	32	9	2	0	0	0	0	0
До 0,2	5—10	Нет	46	43	10	1	0	0	0	0	0
До 0,2	—	Нет	34	31	19	8	5	3	0	0	0
крупнозернистых сплавов (16)											
0,2	5—10	До 0,5	2	29	26	27	11	4	1	0	0
До 0,2	15	Нет	4	22	25	33	9	4	3	0	0
До 0,2	—	0,5	1	20	21	28	16	7	5	1	1
До 0,2	—	Нет	0	13	27	26	14	10	8	2	0

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S/136/61/000/012/004/006
E193/E383

Some properties of ....

Table 1: Composition, physicomechanical properties and microstructure of tungsten-cobalt alloys studied in the present investigation

Key: 1 - Chemical composition, %; 2 - Properties; 3 - Microstructure; 4 - Volume percentage of WC particles of the sizes (μ)... 5 - total carbon; 6 - combined carbon; 7 - specific gravity, g/cm^3; 8 - strength, kg/mm^2; 9 - hardness, H_{RA}; 10 - Coercive force, Oe; 11 - Porosity, %; 12 - Maximum size of individual pores, μ; 13 - Graphite inclusions, %; 14 - Fine-grain alloys; 15 - Average grain-size alloys; 16 - Coarse-grain alloys.

* The remainder is tungsten and additions of other elements, (Si, Al, etc.)

** Dashes indicate that the pore dimensions are less than 5 μ.

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31740
S/136/61/000/012/004/006
E193/E383

Some properties of ....

Fig. 1:

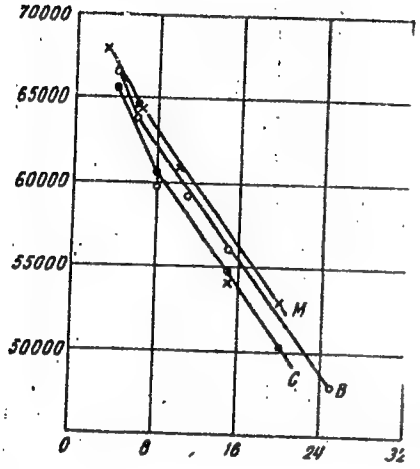


Fig. 2:

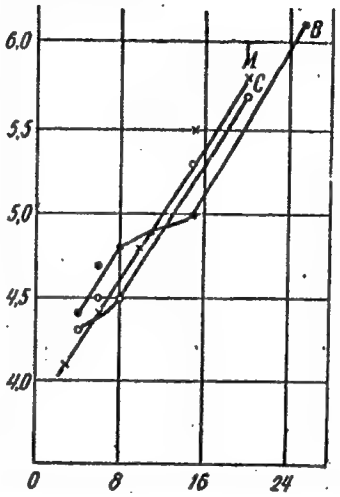
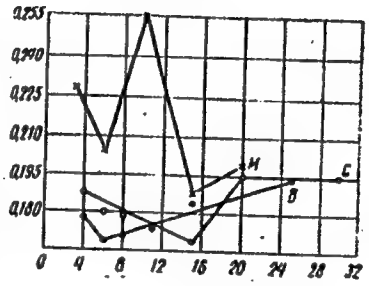


Fig. 3:



Card 6/6

37732

S/180/62/000/002/011/018
E040/E135

IP.1152

AUTHORS: Funke, V.F., Novikova, T.A., and Tumanov, V.I. (Moscow)

TITLE: Structure and properties of tungsten-carbon-cobalt-molybdenum alloys

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, no.2, 1962, 113-118

TEXT: The results are reported of an investigation of the phase composition, chemical composition and structure of the W-C-Co-Mo alloys with 80 and 47% W contents. Special attention was paid to the changes in the alloy properties as a result of variation in their Mo and C contents. Alloys with 80% W (remainder carbon and cobalt) were found to be suitable for many industrial purposes and those with 47% W find application in X-ray structural analysis of the cobalt-base solid solutions. The test specimens were prepared by powder metallurgy techniques, starting with powders of W, Co and Mo,

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by pressing and sintering at 1450 °C (for alloys with 80% W) and 1250 °C (for alloys with 47% W). The above sintering conditions were found to give alloy specimens with the highest density and the best ultimate bending strength. The specimens were then annealed at 1200 and 1000 °C for 2 hours and at 800 °C for 24 hours and allowed to cool, together with the furnace, at the rate of about 1.5 °C/min. The ultimate bending strength was measured at 20 and 800 °C and the hardness of the test alloys was determined at temperatures in the range of 20 to 1000 °C. In addition, determination of the phase composition of the alloys was made by means of X-ray structural and chemical analyses. Special analysis was made of the cobalt and carbide phases. An increase in the Mo content of the test alloys, while the tungsten and carbon content are kept constant, was found to produce a change in the phase composition of the alloys. According to metallographic analysis, the two-phase structure is retained by alloys with 80% W when the molybdenum content is raised from 0 to 1.5%, the two phases being tungsten carbide and a cobalt-base solid solution. At a molybdenum content of 3% or higher, a

third phase was found to appear. The structure of this phase was found to be identical with that of the η_1-phase present in the W-C-Co system (double carbide of tungsten and cobalt). The quantity of this third phase was found to rise with increasing molybdenum concentration. In the alloys with 47% W, the third phase appears at molybdenum contents exceeding 10%, but an increase in the carbon content at a constant molybdenum concentration leads to a reduction in the quantity of the third phase. At the carbon content of 5.36% or more, the test alloys with 80% W and about 3.5% Mo were found to have two phases only: WC phase and the cobalt phase. In the alloys with 47% W content and 10% Mo, the third phase does not form if the carbon content is increased to 4.3%. Phase composition analysis of the test alloys showed that if molybdenum is at concentrations up to 10%, a two-phase structure can exist in the alloy with 47% W. This is taken as an indication of the presence of a solid solution region of molybdenum and carbon in the tungsten carbide phase. It was found that the introduction of molybdenum in the alloys of the W-C-Co system, the raising of molybdenum content up to

3% and the resultant appearance of the double carbide (η_1-phase), as well as a change in the composition of the WC and Co-phases, are accompanied by some reduction of strength at room temperature and some increase of the strength at 800 °C. The hardness of the W-C-Co-Mo alloys is greater than that of the W-C-Co alloys of equal strength.
There are 7 figures and 2 tables.

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov
(All-Union Scientific Research Institute for Hard Alloys)

SUBMITTED: September 18, 1961

S/180/62/000/006/002/022
E111/E451

AUTHORS: Tumanov, V.I., Funke, V.F., Belen'kaya, L.I., Usol'tseva, L.P. (Moscow)

TITLE: Influence of alloy additions on the surface tension of metals of the iron group

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, no.6, 1962, 43-48

TEXT: The effect was investigated of alloy additions to nickel and cobalt on surface tension and weldability of alumina by them; the alloy additions studied were molybdenum, tungsten, titanium, copper, tungsten carbide and titanium carbide. The sessile drop method was used at a vacuum of 10^{-5} mm Hg and temperatures of about 1500°C (1400°C copper). Over the alloying range studied (0.5 to 20 at.%), a relationship was found between, on the one hand, the contact angle, surface tension, interfacial tension and work of adhesion and, on the other, the atomic diameter and thermal stability of the oxides of the alloy additions. With the carbides the greatest reduction in the contact angle and increase in the work of adhesion was obtained when 5% TiC was introduced into cobalt

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(the values then being 62°C and 3600 erg/cm^2, respectively). X-ray structural investigation was made of the contact zone between the alumina plate (made by sintering 99.4% Al_2O_3 in argon for 5 hours at 1950°C to give a porosity of 0.2%) and the alloy. Spinel formation was found to extend to a considerable depth with cobalt. With nickel, α-Al_2O_3 and $NiAl_2O_4$ were found on the plate at a point adjacent to the drop and α-Al_2O_3, $NiAl_2O_4$, TiC, TiO_2 and NiAl on the plate at the contact zone; $NiAl_2O_4$, Ni, TiC, TiO_2 and NiAl were found in the molten drop at the contact zone. Thus the interfacial activity of titanium is evidently due to a reaction between the liquid metal and the solid alumina. There are 5 figures and 5 tables.

SUBMITTED: March 16, 1962

Card 2/2

42022
S/695/62/008/000/013/028
I048/I248

15.2400

AUTHORS: Funke, V.F., Tumanov, V.I., and Trukhanova, Z.S.

TITLE: Effect of alloying on the structure and properties of tungsten carbide - cobalt cerments

SOURCE: Akademiya nauk SSSR. Institut metalurgii, Issledovaniya po zharoprochnym splavam. v.8. 1962. 88-95

TEXT: The contact angle (θ) between WC and molten Co or Ni (measured by the sessile drop method) is 0^{o}, i.e., complete wetting takes place. Addition of TiC to the WC reduces the tendencies of the molten metals to spread and the contact angles increase, e.g., to 21^{o} for the system Co - WC containing 23.6% TiC. Substitution of TiC for part of the WC in WC-Co cermets reduces both the bending strength and the hardness of the cermets. Increasing the Co content in both WC-Co and WC-TiC-Co cermets causes an increase in bending strength, up to a certain maximum which is about 200 kg./sq.mm. in the case of WC-Co containing above 24% Co; this strengthening action of the Co is associated with the increased plasticity of cermets

Card 1/3

Effect of alloying on the structure...

containing larger amounts of Co. The addition of various alloying components affects both the structure and the properties of WC-Co cermets. Thus, the Co phase of the cermet contains 1.28% WC in the absence of alloying components, 1.95, 0.4, and 2.13% WC when 2.09% Cr, 2.43%CrB, and 11.1% Mo respectively are added, and no WC when 1.83% Cu or 2.81% Al is added. The presence of the alloying components causes slight variations in the lattice parameters of both the WC and Co phases. The distribution of these components between the WC and Co phases is fairly balanced, except in the cases of CrB (98.5% of which concentractes in the WC phase) and of Mo and Cu (95.5% and 100% respectively concentrate in the Co phase). All alloying elements mentioned, except Cu in small quantities (about 1%), reduce the bending strength of the cermets at room temperature; at high temperatures (600-800°), however, addition of Mo, Cr, Al, and CrB increases the strength. The additions of Mo, Cr, or CrB causes an increase in both the ambient-temperature and high tem-

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S/659/62/008/000/013/028
I048/I248

Effect of alloying on the structure...

perature hardness of the cermets, while the addition of Al causes a decrease in same. There are 4 figures and 3 tables.

Card 3/3

39763
S/126/62/013/006/010/018
E111/E352

15.2400

AUTHORS: Kreymer, G.S., Vakhovskaya, M.R., Tumanov, V.I. and Pavlova, Z.I.

TITLE: Main mechanical properties and structure of cermets

PERIODICAL: Fizika metallov i metallovedeniye, v. 13, no. 6, 1962, 901 - 911

TEXT: Experiments relating chief mechanical properties to composition, test temperature and carbide-grain size of three-phase TiC-WC-Co alloys. These consist of the following phases: TiC-WC solid solution; structurally free WC + Co with traces of dissolved Ti, W and C. The effect of Co was studied over 4-25 wt.% range with a constant TiC/WC ratio of 15/79, giving an average grain size of 3 μ for the TiC-WC phase and 1.8 μ for the WC phase; that of TiC was over 6-25 wt.% range with 9 wt.% Co, giving an average grain size of 3.7 μ and 2.5 μ for the TiC-WC and WC, respectively. The effec ot carbide-grain size on the mechanical properties was studied on alloys type T15K6 and T6K9 with fine, medium and coarse carbide grains in various combinations. In TiC-WC-Co the breakdown of cobalt

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becomes so significant at temperatures over 500 °C that the increase in its content had little effect. The tensile strength of these alloys became independent of temperature (up to 500 °C) at TiC concentrations of 10 wt.% and over. The fracture mechanisms in WC-Co alloys were different from those in TiC-WC-Co. This difference affected both tensile and impact strengths. The latter was independent of temperature for the alloys BK10 (VK10), T50K9 and T15K6; for the first, this applied only to the 20-400 °C range, above which there was a steep linear growth; for TiC-WC-Co alloys with a virtually continuous carbide skeleton the range was 20 - 1 000 °C. The hardness of three-phase TiC-WC-Co alloys decreased approximately linearly with increasing Co content. The TiC-WC phase showed greatest softening with increasing temperature. There are 10 figures and 2 tables.

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov (All-Union Scientific Research Institute for Hard Alloys)

SUBMITTED: April 17, 1961 (initially)
January 6, 1962 (after revision)

TUMANOV, V.I., inzh.

Design and experimental determination of supertransient parameters of synchronous machines with externally short-circuited magnetic flux. Vest.elektroprom. 33 no.6:41-44 Je '62. (MIRA 15:7)
(Electric machinery, Synchronous)

S/076/62/036/007/010/010
B101/B138

AUTHORS: Tumanov, V. I., Funke, V. F., and Belen'kaya, L. I.

TITLE: Wettability of aluminum oxide and of carbides by metals of the iron group

PERIODICAL: Zhurnal fizicheskoy khimii, v. 36, no. 7, 1962, 1574 - 1577

TEXT: With the use of a slightly modified apparatus by V. N. Yeremenko, Yu. V. Naydich (Ukr. khim. zh., 23, 573, 1957), the surface tension σ, angle of contact θ, and the work of adhesion W_a were determined for the wetting of Al_2O_3 with Ni or Co, and with Ni-Mo or Co-W alloys, and the angle of contact was measured for the wetting of carbides of the system TiC - WC with Ni. Measurements were made at 10^{-5} mm Hg, 1500°C. Results: (1) Addition of Mo or W (up to 10 atom%) increases the wettability of Al_2O_3 with Ni or Co. The first 2 atom% of Mo or W addition show the strongest effect: σ rises from 1225 to 1500 erg/cm^2 with Ni + 2 atom% of Mo, and from 1560 to 1750 erg/cm^2 with Co + 2 atom% of W. (2) The fact

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Wettability of aluminum ...

that the surface tension values of Ni and Co (σ_{Ni} = 1225 erg/cm^2; σ_{Co} = 1560 erg/cm^2) are lower than published figures is attributed to the oxygen content of the metals used (Ni: 0.19% O_2, Co: 0.34% O_2). The increase of σ on addition of Mo or W is caused by separation of O_2 owing to its reduced solubility in the alloy, or by formation of oxides. (3) From 38° at 100% TiC, the angle of contact diminishes slowly to 21° at 70% TiC + 30% WC, and then quickly to 0° at 100% WC. TiC is not completely wettable with Ni; two-phase TiC - WC alloys containing free WC are more wettable than solid TiC - WC solutions. There are 5 figures and 1 table. The most important English-language reference is: M. Humenik, W. D. Kingery, J. Amer. Ceram., 37, 18, 1954.

ASSOCIATION: Nauchno-issledovatel'skiy institut tverdykh splavov (Scientific Research Institute of Hard Alloys)

SUBMITTED: November 28, 1961

Card 2/2

TUMANOV, V.I.; FUNKE, V.F.; PAVLOVA, Z.L.; NOVIKOVA, T.A.; BYSTROVA, K.A.

Effect of the composition and structure of alloys in the system WC - Co and TiC - WC - Co on the strength limit during compression. Fiz. met. i metalloved. 15 no.2:285-289 F '63. (MIRA 16:4)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov.

(Tungsten-cobalt alloys--Metallography)
(Titanium-tungsten-cobalt alloys--Metallography)
(Deformations(Mechanics))

L 18077-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD/HW/JG

ACCESSION NR: AP3004600 S/0126/63/016/001/0113/0116

61
60

AUTHORS: Baskin, M. L.; Tumanov, V. I.; Funke, V. F.

TITLE: Modulus of elasticity for alloys: tungsten carbide-cobalt

SOURCE: Fizika metallov i metallovedeniye, v. 16, no. 1, 1963, 113-116

TOPIC TAGS: tungsten carbide-cobalt, alloy, modulus of elasticity

ABSTRACT: An attempt is made to determine the relation of WC-Co elastic properties to their composition and structure. A formula is offered which expresses the relation of Young's modulus E to the Co content. Three structural variants are discussed, and the formulas for E in each variant are offered. 1) The phases are distributed in layers parallel to the main sample axis;

$$E_a = E_2 + (E_1 - E_2)c_1,$$

2) The phases are distributed in layers perpendicular to the axis;

$$E_6 = E_2 : [1 - c_1(1 - E_2 : E_1)].$$

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ACCESSION NR: AP3004600

3) The matrix distribution of phases: a) cobalt matrix with disseminated WC grains

$$E_3 = E_2 : [1 - c_1(E_1 - E_2) : E_n],$$

$$E_n = E_2 + (E_1 - E_2) \cdot c_1^{2/3}.$$

b) carbide matrix with disseminated Co grains;

$$E_4 = E_1 : [1 + c_2(E_1 - E_2) : E_n'],$$

$$E_n' = E_1 - (E_1 - E_2) c_2^{2/3}.$$

In these formulas E_a, E_1 and E_2, etc., are the elasticity moduli of the variants and c_1 is volumetric concentration of tungsten carbide [Abstracter's note: c_2 is not explained]. The results thus obtained confirm the previous deductions pertaining to the WC-Co structure. These deductions were based on the relation of electrical

L 18077-63

ACCESSION NR: AP3004600

resistivity as well as on the physical and mechanical properties of these alloys to their content of Co. Orig. art.has: 6 formulas and 3 figures.

ASSOCIATION: Vsesoyuzny*y nauchno-issledovatel'skiy institut tverdy*kh splavov (All-Union Scientific Research Institute of Hard Alloys)

SUBMITTED: 19Apr62 DATE ACQ: 27Aug63 ENCL: 00

SUB CODE: ML NO REF SOV: 009 OTHER: 005

Card 3/3

S/032/63/029/003/004/020
B117/B186

AUTHORS: Tumanov, V. I., Trukhanova, Z. S., Funke, V. F., and Shcherbakov, V. G.

TITLE: Electrochemical separation and investigation of the cementation and the carbide phases of high tungsten cobalt alloys

PERIODICAL: Zavodskaya laboratoriya, v. 29, no. 3, 1963, 277-280

TEXT: To determine the composition of the binding phase in WC - Co alloys it was suggested to separate electrochemically the binding and the carbide phase, and to analyze chemically the alloying components. Caustic soda and hydrochloric acid solutions were used as electrolytes and spectroscopically pure graphite electrode as cathode for the electrochemical phase separation. The polarization curves plotted for pure WC and Co at 25°C showed: In 3 M HCl solution, Co dissolves intensely at an anode potential of ~0.1 v and a current density of 0.03 a/cm^2. The anode potential of WC is 0.5 v without voltage applied. When the potential increases to 1.1 - 1.2 v, gaseous chlorine is

separated out and the carbide oxidizes. In 6 M NaCl solution the anode potentials of Co and WC are 0.5 and 0.20 v without voltage being applied. At ~ 0.6 a/cm^2, an intensive discharge of oxygen occurs at the WC anode. WC oxidizes to WO_3, and decomposes to sodium tungstate at ~ 0.8 v. On the Co anode, oxygen is separated out at ~ 0.8 v, and the anode becomes passive. The difference in anode potentials of WC and Co permits the electrochemical separation of the binding and the carbide phase. In electrolytes of different concentrations the WC and Co phases could be dissolved selectively even at high current densities. Optimum conditions for isolating the binding and the carbide phase: for the Co phase, 6 M HCl, 0.03 a/cm^2, electrode voltage 0.8 - 0.9 v; for the WC phase, 6 M NaOH, 0.6 a/cm^2, and 3 v. The method was used to separate the phases mentioned in WC - Co alloys containing molybdenum, chromium, and aluminum. The phase composition and the lattice constant of the Co phase in alloys containing less than 4% by weight of Co could be determined by electrolytic enrichment with Co of the alloy surface. There are 2 figures and 4 tables.

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov (All-Union Scientific Research Institute of High Alloys)

BASKIN, M.L.; TUMANOV, V.I.

Device for measuring specific electric resistance. Zav.lab. 29 no.4:508-509 '63. (MIRA 16:5)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov.
(Electric resistance--Measurement)

TUMANOV, V.I.; FUNKE, V.F.; PAVLOVA, Z.I.; IL'IN, Yu.F.

Determination of the tensile strength of solid alloys. Zav.lab. 29 no.8:981-983 '63. (MIRA 16:9)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov.
(Alloys—Testing)

ACCESSION NR: AP4019617 S/0279/64/000/001/0170/0175

AUTHORS: Tumanov, V. I. (Moscow); Funke, V. F. (Moscow); Baskin, M. L. (Moscow); Novikova, T. A. (Moscow)

TITLE: Temperature effect on physical properties of tungsten carbide and cobalt alloys

SOURCE: AN SSSR. Izv. Metallurgiya i gornoye delo, no. 1, 1964, 170-175

TOPIC TAGS: cermet alloy, metalloceramic solid alloy, WC+Co alloy, WC+Co physical properties, WC grain size, WC+Co thermal expansion, WC + Co electrical resistivity

ABSTRACT: This work was carried out in order to determine the variation in the elasticity modulus, linear expansion coefficient, and specific electrical resistivity of WC+Co with respect to the temperature changes (800-1000C), the cobalt content, and the grain size of the WC-phase. The samples consisted of two sets: 1) the alloys containing 0-50 wt% of Co and made up of equal WC-phase grains (2.9-2.6 μ); 2) the alloys with a constant Co content (6%) and with varied grain sizes of the WC-phase (1.7-3.7 μ). The results are shown on Figures 1, 2 and 3 of the

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ACCESSION NR: AP4019817

Enclosures. The authors conclude that the experimental data confirmed the general idea that Co may occur in WC-Co alloys either in the form of thin capillary films or in large inclusions. The varying amounts of the two forms determine the alloy properties with the change in Co content and grain size of the WC-phase. Orig. art. has: 1 table and 3 figures.

ASSOCIATION: none

SUBMITTED: 15May63 DATE ACQ: 31Mar64 ENCL: 03

SUB CODE: ML NO REF SOV: 007 OTHER: 001

Card 2/5

ACCESSION NR: AP4029208 S/0226/64/000/002/0057/0060

AUTHOR: Tumanov, V. I.; Funke, V. F.; Trukhanova, Z. S.; Novikova, T. A.; Kuznetsova, K. F.

TITLE: Heat treatment of tungsten carbide-cobalt alloys

SOURCE: Poroshkovaya metallurgiya, no. 2, 1964, 57-60

TOPIC TAGS: tungsten carbide, cobalt, heat treatment, carbon, tungsten, tungsten carbide based alloy, cobalt containing alloy, binding phase

ABSTRACT: In this paper the authors present the results of studies of the effect of the cooling rate on the composition of the binding phase and the bending strength of tungsten carbide-cobalt alloys. The effect of the cobalt content is plotted in graphs. The authors draw the following conclusions: 1) the composition of the binding phase does not, in practice, depend on the cooling rate within the investigated temperature range, and 2) in the examination of the dependence of the bending strength on the composition of tungsten carbide-cobalt alloys, it is also necessary to consider the change of thermal stresses. Orig. art. has: 3 figures.

ASSOCIATION: Vsesoyuzny*y nauchno-issleovatel'skiy institut tverdy*kh spalvov (All-Union Scientific Research Institute of Solid Alloys)

Card 1/2

Sub: 24 JAN 63

ACC NR: AP6034020 SOURCE CODE: UR/0226/66/000/010/0071/0077

AUTHOR: Tumanov, V. I.; Gol'dberg, Z. A.; Chernyshev, V. V. Pavlova, Z. I. (Deceased)

ORG: All-Union Scientific Research Institute of Hard Alloys (Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov)

TITLE: Thermal stability of alloys of tungsten-cobalt carbides

SOURCE: Poroshkovaya metallurgiya, no. 10, 1966, 71-77

TOPIC TAGS: thermal shock simulation, heat resistant alloy, tungsten carbide, cobalt, bend strength, grain size, grain structure, hardness

ABSTRACT: Thermal shock testing of alloys of tungsten-cobalt was made by water quenching samples from temperatures up to 1120°K. The furnace capacity was sufficiently great to test 20-40 samples simultaneously. Specimens were held 5 min in the furnace and 0.5 min in the quenching bath. Thermal shock stability was measured in terms of superficial cracks and the decrease in ultimate bend strength after thermal cycling. The cobalt content of the samples ranged from 1 to 30 wt %, while some samples containing 20-30% cobalt were alloyed with 0.8 or 2.1% titanium, chromium, or molybdenum. The porosity did not exceed 0.2 vol %. The first set of experiments was conducted on 5 × × 5 × 35 mm samples quenched from 770°K. Thermal shock resistance increased sharply above 15% Co. Up to 6% Co the number of thermal shock cycles needed to induce macro-

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cracks was 7 or less; at 15 to 30% Co no cracking was observed after 500 cycles. Small grained samples had a lower thermal shock stability. A microstructural analysis was made on samples with 25% Co, alloyed with either Ti, Cr, or Mo. The volume distribution of grain size was given for the different alloys, before and after 300 cycles of thermal shock testing. The ultimate bend strength of 2 × 5 × 35 mm samples, quenched from 1120°K, is given as a function of the number of cycles. The greatest drop in strength occurred after 100 cycles. Alloy VK20 (20% Co) had the highest bend strength while VK30 (30% Co) had the lowest for all thermal shock cycles, ranging up to 500. The effect of thermal cycling on Vickers hardness was negligible. It is concluded that the mechanism of strength decrease during thermal cycling is associated with fine structural changes, which could not be observed by the techniques described above. Orig. art. has: 2 figures, 4 tables.

SUB CODE: 11/ SUBM DATE: 04Apr64/ ORIG REF: 003/ OTH REF: 005

TUMANOV, V.I. (Moskva); FUNKE, V.F. (Moskva); BASKIN, M.L. (Moskva); NOVIKOVA, T.A. (Moskva)

Effect of temperature on the physical properties of tungsten carbide-cobalt alloys. Izv. AN SSSR. Met. i gor. delo no.1: 170-175 Ja-F '64. (MIRA 17:4)

SHCHETILINA, Ye.A. (Moskva); TUMANOV, V.I. (Moskva); SEREBROVA, O.I. (Moskva)

Solubility of refractory metal carbides in cobalt. Izv. AN SSSR. Met. i gor. delo no.6:142-147 N-D '64. (MIRA 18:3)

KREYMER, G.S.; TUMANOV, V.I.; ALEKSEYEVA, N.A.; PAVLOVA, Z.I.; BASKIN, M.L.; KUZNETSOVA, K.F.

Properties of ceramic metal hard alloys of WC-TiC-Co with additions of tantalum carbide. Porosh. met. 5 no.4:35-43 '65. (MIRA 18:5)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov.

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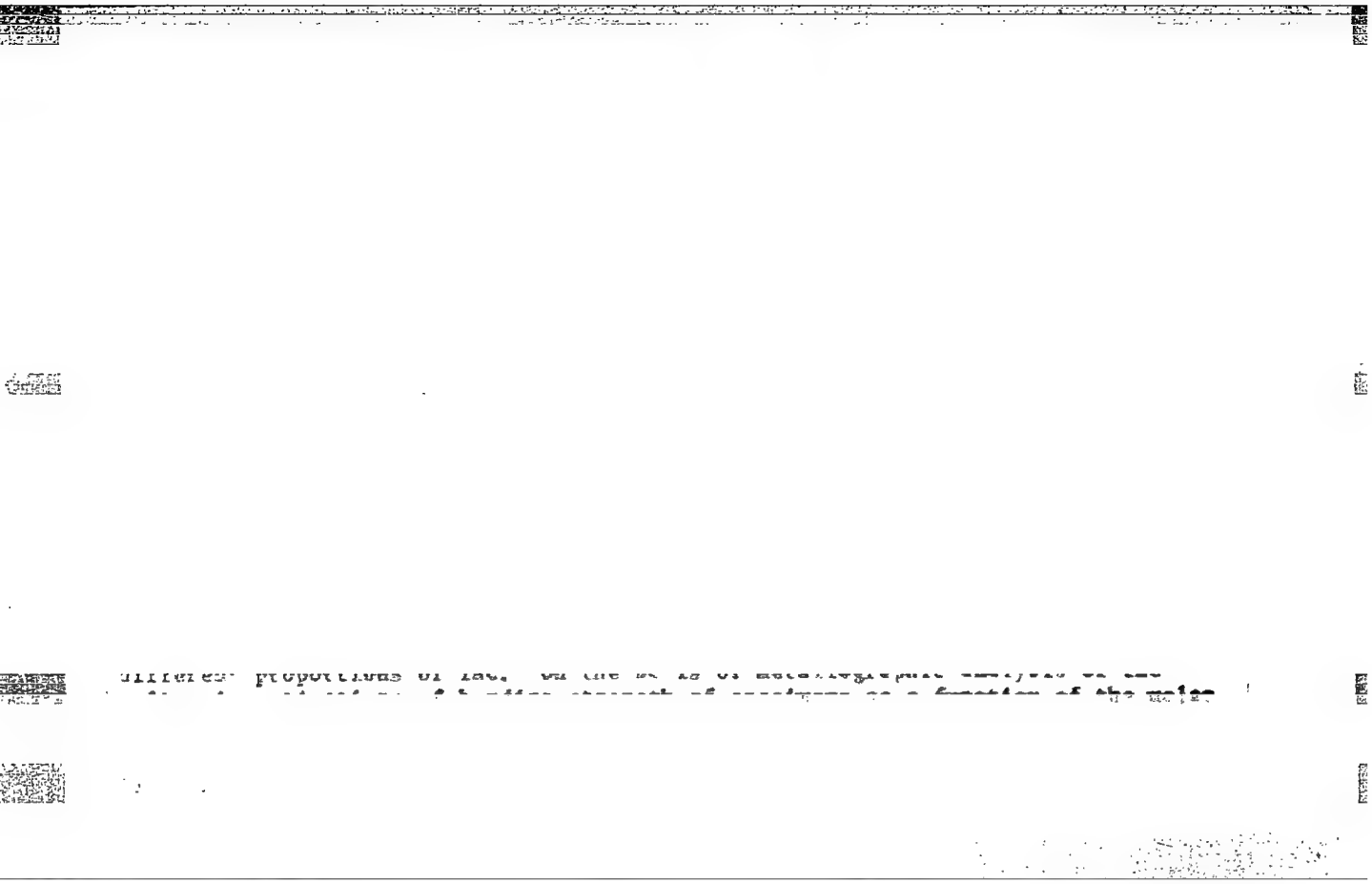
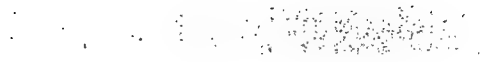
APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001757420012-2"





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Card 3/3

KREYMER, G.S.; TUMANOV, V.I.; KAMENSKAYA, D.S.; PAVLOV, Z.

Strength limit and rupture mechanism of WC-Co ceramic metal hard alloys under the effect of compression. Fiz. met. i metalloved. 17 no.4:572-577 Ap '64. (MIRA 17:8)

1. Vsesoyuznyy institut tverdykh splavov.

TUMANOV, V.I., inzh.

Determination of transient and supertransient parameters of synchronous machines with externally short-circuited magnetic circuits. Elektrotekhnika 35 no.4:4-7 Ap '64. (MIRA 17:4)

ZAKHVATKIN, Ye.V.; NAUMOV, V.I.; TUMANOV, V.M.

Automatic welding of cardan shafts and the winch roller on the "Ural-375" motor vehicle. Avtom. svar. 17 no.10:61-63 O'64 (MIRA 18:1)

1. Ural'skiy avtomobil'nyy zavod.

TERNOV, I.M.; TUMANOV, V.S.

Movement of polarized electrons in a magnetic field. Izv. vys. ucheb. zav.; fiz. no. 1:155-163 '60. (MIRA 13:12)

1.Moskovskiy gosudarstvennyy universitet imeni M.V. Lomonosova.
(Electrons) (Magnetic fields)

39985
S/181/62/004/008/032/041
B108/B102

24.7100

AUTHOR: Tumanov, V. S.

TITLE: Energy level splitting in a crystal field

PERIODICAL: Fizika tverdogo tela, v. 4, no. 8, 1962, 2264 - 2265

TEXT: The level splitting of particles with a moment of momentum in an internal crystalline field can be calculated more easily than by group theoretical considerations if the following formulas for the characters of the irreducible representations of the rotation group are used: for integral moment j:

$$\chi(0)=2j+1;\ \chi(\pi)=1-2j+4\left[\frac{j}{2}\right];\ \chi\left(\frac{\pi}{2}\right)=\chi\left(\frac{3\pi}{2}\right)=$$
$$=1-2\left[\frac{j}{2}\right]+4\left[\frac{j}{4}\right];\ \chi\left(\frac{2\pi}{3}\right)=\chi\left(\frac{4\pi}{3}\right)=1-j+3\left[\frac{j}{3}\right];$$
$$\chi\left(\frac{2\pi}{5}\right)+\chi\left(\frac{4\pi}{5}\right)=2-j+5\left[\frac{j}{5}\right];\ \chi\left(\frac{8\pi}{5}\right)=\chi\left(\frac{2\pi}{5}\right);\ \chi\left(\frac{6\pi}{5}\right)=\chi\left(\frac{4\pi}{5}\right);$$

Card 1/2

Energy level splitting ... S/181/62/004/008/032/041
B108/B102

for half integral j:

$$\chi(0)=-\chi(2\pi)=2j+1;\quad \chi(\pi)=0;\quad \chi\left(\frac{2\pi}{3}\right)=-\chi\left(\frac{4\pi}{3}\right)=$$
$$=\frac{1}{2}+j-3\left[\frac{j+2}{3}\right];\quad \chi\left(\frac{2\pi}{5}\right)-\chi\left(\frac{4\pi}{5}\right)=\frac{1}{2}+j-5\left[\frac{j+3}{5}\right],$$
$$\chi\left(\frac{8\pi}{5}\right)=-\chi\left(\frac{2\pi}{5}\right);\quad \chi\left(\frac{6\pi}{5}\right)=-\chi\left(\frac{4\pi}{5}\right).$$

[a] denotes the integral part of the number a. From these formulas it follows that a field hexagonal or trigonal symmetry in the case of integral j will split only triply degenerate levels, if this field appears as a perturbation in a field of cubic symmetry. There are 2 tables.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

SUBMITTED: April 4, 1962

Card 2/2

L 30239-66

ACC NR: AP6020163 SOURCE CODE: UR/0188/65/000/004/0089/0090

35
B

AUTHOR: Klyshko, D. N.; Tumanov, V. S.; Yarygin, V. P.

ORG: Department of Radio Engineering, Moscow State University (Kafedra radiotekhniki Moskovskogo gosudarstvennogo universiteta)

TITLE: Heterodyning by means of a two-level system

SOURCE: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 4, 1965, 89-90

TOPIC TAGS: matrix element, Zeeman effect, magnetization, ferrite

ABSTRACT: It is shown that heterodyning can be accomplished by utilizing the nonlinear properties of a two-level system with diagonal matrix elements of the dipole moment $\vec{\mu}$. This is exemplified by observations of this effect at radio frequencies with the aid of Zeeman levels of the free radical diphenylpicrylhydrazyl (DPH). The effect is readily calculated on the basis of the equations of a density matrix with phenomenological relaxation times T_1 and T_2 for the case of a system with Bohr frequency ω_0 which is acted upon by two monochromatic fields. Proceeding from the appropriate formula, the authors derive the expression for the Fourier component of magnetization (or polarization) of the system at the difference frequency $\omega_1 \sim \omega_0$ and, thence the equation for a "magnetic" two-level system with $T_1 = T_2$. This was experimentally

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ACC NR: AP6020163

verified by placing several grams of polycrystalline DPH in a system of three inductance coils with mutually perpendicular axes and supplying voltages of different frequencies, $\omega_1/2\pi$ =25 mc and $\omega_2/2\pi$ =22 mc, to two of the coils; the axis of the third coil, tuned to 3 mc, is positioned parallel to $\vec{H}_0$ (intensity of constant magnetic field), and the amplified difference-frequency signal induced in this coil is observed on an oscillograph screen. The experimental findings were found to be in agreement with the calculations. It is further pointed out that the effect examined above has nothing in common with the frequency-conversion effect in ferrites; it is significant, however, that in the case of the two-level system the conversion coefficient may be increased, owing to the parametric regeneration of the system at the signal frequency observed during its partial saturation by a field with the frequency ω_1. Orig. art. has: 1 figure and 2 formulas. [JPRS]

SUB CODE: 20 / SUBM DATE: 01Feb65 / ORIG REF: 002 / OTH REF: 004

Card 2/2

L 09240-67 EWT(1)
ACC NR: AP7002788 SOURCE CODE: UR/0139/66/000/004/0151/0158

33

AUTHOR: Tumanov, V. S.

ORG: Moscow State University im. M. V. Lomonosov (Moskovskiy gosuniversitet)

TITLE: Relativistic wave equations

SOURCE: IVUZ. Fizika, no. 4, 1966, 151-158

TOPIC TAGS: relativistic particle, wave equation

ABSTRACT: A method is given for deriving relativistic wave equations in matrix form for particles with higher-order spins. Values are given for the constants of the matrix β^{ν}, the inversion operator matrix, and the scalar matrix, which is included in the current equation for particles with spins 0, 1/2, 3/2, and 2.

Higher-order spins are important because of the numerous resonances that have been found including those with long life times. Under certain conditions the equations for particles with spins 0 to 2 are determined uniquely. Difficulties are encountered due to the presence of an external electromagnetic field; unique equations for free particles can be written in spinor, tensor, or spin-tensor forms. The matrix form of the equations requires auxiliary data, even when an electromagnetic field is absent. The relativistic wave equation is also useful in describing the properties of nonrelativistic particles. Orig. art. has: 13 formulas. [JPRS: 39,040]

SUB CODE: 20 / SUBM DATE: 12Jan65 / ORIG REF: 003 / OTH REF: 007

Card 1/1 mlz

0925 1671

L 6352-66 EWT(1)/EWA(h)

ACC NR: AP5020363 SOURCE CODE: UR/0141/65/008/003/0513/0521

AUTHOR: Klyshko, D. N.; Konstantinov, Yu. S.; Tumanov, V. S.

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

TITLE: The parametric excitation of a two-level system dur[illegible] saturation

SOURCE: IVUZ. Radiofizika, v. 8, no. 3, 1965, 513-521

TOPIC TAGS: magnetic pumping, electromagnetic pump, electron paramagnetic resonance, parametric resonance

ABSTRACT: The possibilities of parametric amplification of electromagnetic oscillations when a substance with a narrow absorption line is illuminated by an auxiliary monochromatic signal (pumping signal) are analyzed. It is assumed that the active substance is inside the resonator and that the resonator has two noninteracting types of oscillations with natural frequencies close to the pumping frequencies. An expression is obtained for the magnetization (or polarization in the case of electric dipole interaction) of a two-level system in the presence of an intense pumping field with a frequency ω_1 and two weak fields with frequencies ω_2 and

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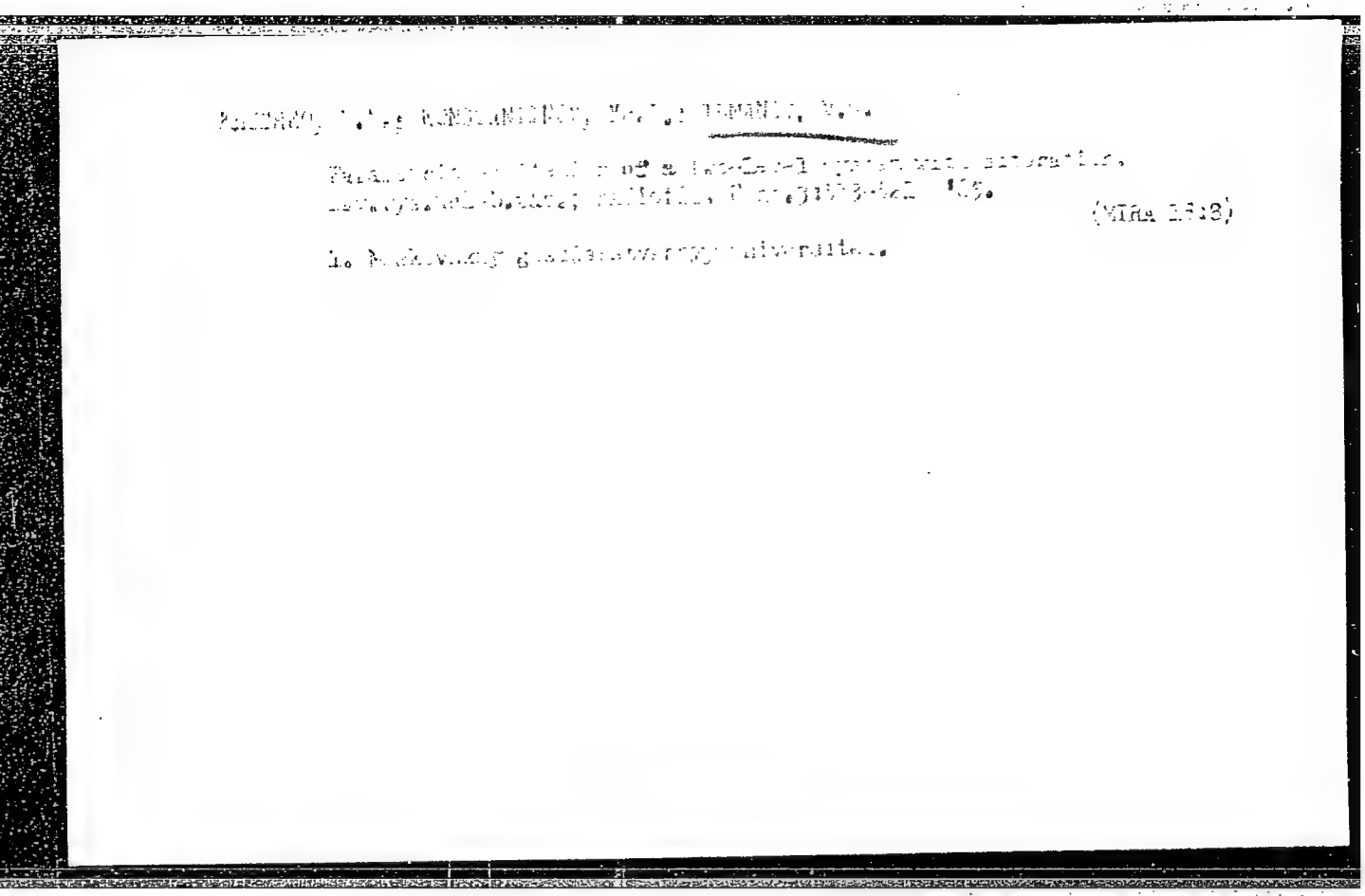
L 6352-66

ACC NR: AP5020363

$2\omega_1 - \omega_2$. This expression applies these parametric effects to amplify UHF signals. Experimental results are presented which confirm the possibility of obtaining negative absorption at the partially saturated line of electron paramagnetic resonance. The experiment utilized two coils with perpendicular axes and tuned to frequencies of 20 and 24 Mc. The axes of the coils were perpendicular to a constant magnetic field H_0 which was varied in the range from 0 to 20 oersteds. The 24-Mc coil developed a saturation field with an intensity up to 11 oersteds in the polycrystalline sample placed in the second coil. The second coil generated the electron parametric resonant signal in a conventional manner. The advantages of this method of excitation include a wide selection of operating substances, the same range of signal and pumping frequencies, and simplicity of construction. In closing the authors express their appreciation to C. D. Gvozdover for his attention to the work. Orig. art. has: 18 equations and 3 figures.

SUB CODE: EM,GP/ SUBM DATE: 21Mar64/ ORIG REF: 001/ OTH REF: 005

Card 2/2 RDB



TUMANOV, V.S.

Splitting of energy levels in an intracrystalline field.
Fiz. tver. tela 4 no.8:2264-2265 Ag '62. (MIRA 15:11)

1. Moskovskiy gosudarstvennyy universitet imeni M.V. Lomonosova.
(Crystallography, Mathematical)

TUMANOV, V.S.

Theory of cross relaxation in paramagnetic crystals. Fiz. tver. tela 4 no.9:2419-2425 S '62. (MIRA 15:9)

1. Moskovskiy gosudarstvennyy universitet imeni Lomonosova.
(Paramagnetic resonance and relaxation)

KLYSHKO, D.N., TUMANOV, V.S.; USHAKOVA, L.A.

Effect of cross-relaxation on population inversion in ruby. Zhur. eksp. i teor. fiz. 43 no.1:25-30 Jl '62. (MIRA 15:9)

1. Moskovskiy gosudarstvennyy universitet.
(Paramagnetic resonance and relaxation)
(Quantum theory) (Rubies)

APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001757420012-2"

APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001757420012-2"

S/139/60/000/03/019/045
E032/E314

AUTHOR: Tumanov, V.S.

TITLE: On the Interaction of an Electron Moving in a Magnetic Field with Vacuum

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, Nr 3, pp 112 - 116 (USSR)

ABSTRACT: In previous papers by Ternov and the present author (Refs 1,2) the effect of fluctuations in the photon vacuum on the spin of an electron moving in the uniform magnetic field was considered. The starting point was the Dirac equation with radiational corrections which on the first approximation is of the form given by Eq (1). The function S^c depends on the accurate Dirac functions for an electron in a magnetic field, i.e. the functions given by Eq (2). In the case of a stationary external field when S^c is of the form given by Eq (2), integration of Eq (1) with respect to time leads to Eq (3), where H is the Dirac Hamiltonian and K is given by Eq (4). In Ref 2, a calculation was made of the non-diagonal matrix element $W_{s,-s}$. The present

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E032/E314

On the Interaction of an Electron Moving in a Magnetic Field with Vacuum

paper is concerned with the matrix element $W_{s,s'}$, which is the radiational correction to the energy. The function S^c cannot be now expanded in powers of the potential of the external field since the potential of a uniform field cannot be looked upon as a perturbation (Ref 1). The calculation of $W_{s,s'}$ involves firstly integration over space and, secondly, the summation over the virtual states of the electron. Closed integrals are obtained for the matrix elements which hold for any magnetic-field strengths. The non-relativistic form of the expressions obtained is in agreement with the result obtained by Gupta (Ref 5). The matrix elements are calculated as functions of H/H_o where $H_o \sim 10^{-13}$ Oe. The coefficients of $(H/H_o)^2$ are determined. Acknowledgments are made to Professor A.A. Sokolov and Docent I.M. Ternov for constant interest and discussions.

Card2/3

S/139/60/000/03/019/045
E032/E314

On the Interaction of an Electron Moving in a Magnetic Field with Vacuum

There are 6 references, 1 of which is English and 5 are Soviet.

ASSOCIATION: Moskovskiy gosuniversitet imeni M.V. Lomonosova (Moscow State University imeni M.V. Lomonosov)

SUBMITTED: September 23, 1959

VC

Card 3/3

L 10951-66 FBD/EWT(1)/EEC(k)-2/T/EWP(k)/EWA(m)-2/EWA(h) SOTB/EWP(s) WW 36
ACC NR: AP6002286 SOURCE CODE: UR/0168/65/000/006/0043/0048

AUTHOR: Klyshko, D. N.; Penin, A. N.; Polkovinikov, B. F.; Tumanov, V. S. 44,55

ORG: Moscow University, Department of Radio Engineering (Moskovskiy universitet, kafedra radiotekhniki) 44,55

TITLE: Stimulated Raman scattering in the radio-frequency range

SOURCE: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 6, 1965, 43-48

TOPIC TAGS: Raman scattering, combination scattering, scattering matrix, radio wave scattering, laser, Raman effect, magnetic field, photon, microwave

ABSTRACT: An investigation was made of 1) the stimulated microwave Raman scattering at various orientations of a constant magnetic field H_0 in a plane formed by two mutually perpendicular fields H_1 and H_2, and 2) three-photon absorption when two of the photons have different frequencies. Two methods were used to analyze the two-photon processes: 1) the quasi-classical method, using equations for the density matrix and the nonquantized field, and 2) the probability method. The density matrix method was used to derive a formula for the magnetization vector of a two-level spin system in a strong field oriented perpendicularly to a constant field, and in a weak field oriented parallel to the field. The probability method was used in deriving the formula for the probability of three-photon absorption. The experiments were performed with a free radical of diphenyl-

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